

The Bioinformatics Lab

Install Debian onto USB stick

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Preparing the installation

- Download Debian image, which is suitable to your processor architecture from the Debian website.
- Burn bootable CD and start the computer from the CD
- Choose installation method

Installation location

- RAID (Redundant Array of Independent Disks) -> later
- LVM (Logical Volume Manager)
 - higher level-view of disk storage
 - storages are created under the control of LVM
 - can be resized and moved around
 - allows management of storage volumes in user-defined groups
- iSCSI (Internet Small Computer System Interface)
 - facilitate data transfers over IP-based networks
 - manage storage over long distances

Unencrypted partitioning

- Three different partitions
- /boot: 512 MB, file system: ext4, mounting point: /boot, bootable flag: on
- swap: 512 MB, use as: "swap area"
- /: remaining free space, file system: ext4, mounting point: /, bootable flag: off

Encrypted partitioning

- Two different partitions
- /boot: 512 MB, file system: ext4, mounting point: /boot, bootable flag: on
- remaining space: one encrypted partition (Physical volume for encryption)
- LVM (Logical volume manager) to divide the encrypted partition (multiple logical volumes in different volume groups)
 - swap: 512 MB, use as: "swap area"
 - remaining space as "root", file system: ext4, mounting point: /, bootable flag: off

File systems

- ext3 (extended 3):
 - journaling file system
 - commonly used in linux
 - Htree (similar to Btree) for large directories
- ext4 (extended 4):
 - based on ext3
 - can handle larger files (up to 16TB) and volumes (up to 1 EB)
 - backward compatible to ext3
- btrfs (butterfly fs)
 - New file system (in implementation phase), already available in the kernel
 - snapshots (save fs changes -> possibility for rollbacks)
 - On the fly data compression
 - Subvolumes
 - Deduplication (save identical files only once)

File systems cont'd

- ntfs:
 - standard Windows file system
 - journaling file system
 - readable for Linux
 - experimental writeable for Linux
- zfs:
 - combined file system and logical volume manager
 - snapshots
- xfs:
 - journaling file system
 - full 64 bit addressing (can handle a lot of small files)

File systems cont'd

- swap:
 - area on disk, temporarily holds a process memory image
 - virtual memory (compare to Windows)
 - enlarges RAM
- tmpfs:
 - virtual memory file system
 - appears as a mounted file system
 - storage is only temporary

Bootloader installation

- Installation of GRUB2
- install the bootloader to the master boot record: NO
- install bootloader on your /boot partition on your USB stick (/dev/sdb1)

Bootloader: Linux and Windows

- Install GRUB2 to the master boot record (overwrite the Windows bootloader)
- Boot linux and change /boot/grub/grub.cfg:

```
menuentry 'Debian Linux' {  
  set root='(hd0,2)'  
  linux /boot/vmlinuz-<kernelversion>  
  initrd /boot/initrd.img-<kernelversion>  
}  
menuentry 'Windows' {  
  set root='(hd0,1)'  
  chainloader +1}
```

Different Bootloader

- GRUB
 - GRand Unified Bootloader
 - Multiboot
 - Installation on the master boot record or /boot
- syslinux
 - runs on MS-DOS/Windows FAT filesystem
 - mainly: creation of rescue and other boot disks
- extlinux
 - syslinux derivate
 - boots from a Linux ext2/ext3/ext4 filesystem
- pxelinux
 - syslinux derivate
 - booting Linux from a network server

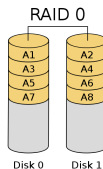
RAID - general idea

- Redundant Array of Independent Disks
- increased storage functions and reliability through redundancy
- multiple disk drive components into a logical unit
- hardware RAID: mainboard with RAID controller (mostly on server, faster method)
- software RAID: drivers which emulates a RAID controller (mostly on Desktop PCs)

RAID variants

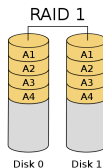
- RAID 0 (Block-level stripping without parity or mirroring)

- Fault Tolerance: none
- Min #disks: 2
- Space efficiency: 1



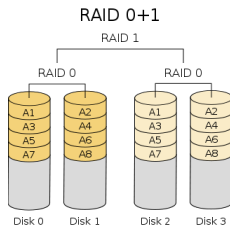
- RAID 1 (Mirroring without parity or stripping)

- Fault Tolerance: $n-1$ disks
- Min #disks: 2
- Space efficiency: $n/2$



RAID variants cont'd

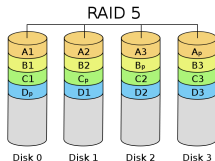
- RAID 10 (Block-level striping without parity)
 - combines RAID 0 and RAID 1
 - Fault Tolerance: $n-1$ disks
 - Min #disks: 4
 - Space efficiency: $n/2$



RAID variants cont'd

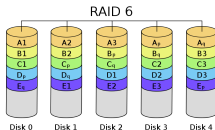
- RAID 5 (Block-level striping with dedicated parity)

- Fault Tolerance: 1 disk
- Min #disks: 3
- Space efficiency: $1 - 1/n$



- RAID 6 (Block-level striping with distributed parity)

- Fault Tolerance: 2 disk
- Min #disks: 4
- Space efficiency: $1 - 2/n$



Package management systems

- collection of software tools
- automate the process of installing, updating, removing and configuring software
- normally: database of software dependencies and version information

Package management systems cont'd

- dpkg
 - base of the Debian package management system
 - install and remove of .deb packages
 - low level tool
 - no deal with package relations
- apt (Advanced Packaging Tool)
 - front-end for dpkg (can also work with rpm packages)
 - Installation and Removal of Software on Debian
 - automatic retrieval, configuration and installation of software packages
 - sources are defined in `/etc/apt/sources.list`
 - calls dpkg after downloading the sources
 - Installation from binary files or by compiling source code

Package management systems cont'd

- aptitude
 - front-end for apt
 - text-based ncurses-based interface
 - easy access to all versions of a package
- synaptic
 - graphical interface for apt

Sources

- LVM <http://www.tldp.org/HOWTO/LVM-HOWTO/>
- iSCSI
 - <http://searchstorage.techtarget.com/definition/iSCSI>
 - <http://en.wikipedia.org/wiki/ISCSI>
- Filesystems:
 - ext3 <http://en.wikipedia.org/wiki/Ext3>
 - ext4 <http://en.wikipedia.org/wiki/Ext4>
 - btrfs https://btrfs.wiki.kernel.org/index.php/Main_Page
 - ntfs <http://en.wikipedia.org/wiki/NTFS>
 - zfs
 - <http://hub.opensolaris.org/bin/view/Community+Group+zfs/WebHome>
 - xfs <http://oss.sgi.com/projects/xfs/>
 - swap <https://help.ubuntu.com/community/SwapFaq>
 - tmpfs <http://en.wikipedia.org/wiki/Tmpfs>

Sources cont'd

- Bootloader:
 - GRUB2 <http://www.gnu.org/software/grub/index.html>
 - syslinux <http://syslinux.zytor.com/wiki/index.php/SYSLINUX>
 - extlinux <http://syslinux.zytor.com/wiki/index.php/EXTLINUX>
 - pxelinux <http://syslinux.zytor.com/wiki/index.php/PXELINUX>
- RAID:
 - <http://en.wikipedia.org/wiki/RAID>
 - <http://searchstorage.techtarget.com/definition/RAID>
- Package managers:
 - general <http://www.debian.org/doc/FAQ/chpkgtools.en.html>
 - dpkg <http://en.wikipedia.org/wiki/Dpkg>
 - apt http://en.wikipedia.org/wiki/Advanced_Packaging_Tool
 - synaptic <http://www.nongnu.org/synaptic/>